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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Yuji Takakuwa

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YOUNG & THOMPSON
209 Madison Street
Suite 500
ALEXANDRIA, VA 22314

EXAMINER

BURKHART, ELIZABETH A

ART UNIT

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1792

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/520,633	Applicant(s) TAKAKUWA, YUJI	
	Examiner Elizabeth Burkhart	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 March 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-24 is/are pending in the application.
- 4a) Of the above claim(s) 24 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>3/12/09</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Claims 2-24 are pending in the application. Amended claims 2-20, cancelled claim 1, and new claims 21-24 have been noted. The amendment filed 3/19/2009 has been entered and carefully considered.

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Election/Restrictions

3. Newly submitted claim 24 is directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: There is a lack of unity of invention between claim 24 and claims 2-23. Motoyama et al (JP2002-075876) teaches an apparatus comprising: a container **3** adapted to treat the substrate **2** having an inlet **6** for a process gas and adapted to maintain an internal pressure within the claimed range, a light source **4** having a light output window **5** adapted to irradiate UV rays **11** having a photon energy within the claimed range, an electrode having a plurality of openings arranged between the light source **4** and the substrate **2**, and a power source for applying a negative bias to the substrate **2** with respect to the electrode (Fig. 1 and 2, Abstract, [0010]-[0021]). Since the limitations of claim 24 fail to define a contribution over the cited reference, they fail to constitute a special technical feature and hence there is a lack of unity between claim 24 and claims 2-23.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for

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prosecution on the merits. Accordingly, claim 24 is withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Response to Arguments

4. Applicant's arguments, see p. 14 filed 3/19/2009, with respect to the Inayoshi reference have been fully considered and are persuasive. Applicant argues that Inayoshi teaches applying a positive bias voltage to the substrate which stands in contrast to the method of new claim 21 (and original claim 1) which provides applying a negative bias voltage to the substrate. The examiner agrees. Inayoshi teaches applying a negative bias voltage to the mesh electrode and positive bias voltage to the substrate and it would not have been obvious to modify the process of Inayoshi such that a negative bias is applied to the substrate. Therefore, the previous rejections have been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Motoyama et al (JP 2002-075876) (See rejection below).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

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2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
5. Claims 2, 7-11, 16, and 20-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki ('610) in view of Motoyama et al (JP 2002-075876) and as evidenced by Zhang et al.

Yamazaki teaches a surface treating method wherein a semiconductor substrate is placed in a process chamber, pressure is maintained within the claimed range, ultraviolet light is irradiated from a light source housed in the process chamber having a light output window (quartz), and a process gas is supplied into the process chamber to treat the surface of the substrate. The UV light is generated using a low pressure mercury lamp. The process gas comprises silane or polysilanes and ammonia or hydrazine for forming a SiN film on the substrate (Abstract, Fig. 1, Col. 2-Col. 3).

Yamazaki does not teach applying a negative bias voltage to the substrate.

Motoyama teaches a similar surface treating method (photo-CVD) wherein a semiconductor substrate is placed in a chamber, the pressure is maintained within the claimed range, UV light is irradiated from a light source housed in the chamber having a quartz window, a process gas is supplied to treat the surface of the substrate, and a plasma is produced in the vicinity of the surface of the substrate. The surface treatment may be the deposition of a silicon nitride film. A negative bias is applied to the substrate in order to increase the generation rate of film formation and improve the film quality (Abstract, Fig. 1 and 2, [0010]-[0021], [0037] of machine translation).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to apply a negative bias to the substrate as suggested by Motoyama in the process of Yamazaki in order to increase the generation rate of film formation and improve the quality of the film.

Regarding Claims 21-23, the specification discloses that ultraviolet in the 3-10 eV energy region can be generated by low-pressure mercury lamps (p. 2, par. 5), thus the low pressure mercury lamp of Yamazaki would inherently produce UV having a photon energy within the claimed range. Also, the Xe lamp of Motoyama emitting short wavelength radiation [0019] would have a photon energy within the claimed range as evidenced by Zhang et al (p. 2964, col. 2, p. 2965, col. 2). Further the instant specification defines "conductive substrate" to include wideband gap semiconductors that are not conductive in room temperature but become conductive at high temperatures. Yamazaki and Motoyama disclose using a silicon substrate. Silicon is not conductive at room temperature but becomes conductive at higher temperatures. Thus, it would have been obvious to use other semiconductor substrates exhibiting similar properties, such as wideband gap semiconductors, especially since Yamazaki discloses that the substrate may be a substrate that has a semiconductor element formed thereon (Col. 1, line 30).

Regarding Claims 7, 11, 22, and 23, Motoyama discloses that a mesh electrode may be placed between the light source and substrate and a bias voltage, negative on the substrate side, is applied between said electrode and the substrate [0016]-[0017].

Thus, claims 2, 7-11, 16, and 20-23 would have been obvious within the meaning of 35 USC 103 over the combined teachings of Yamazaki and Motoyama.

6. Claims 3, 12, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki ('610) in view of Motoyama et al (JP 2002-075876) as applied above and further in view of Ray et al.

Yamazaki and Motoyama do not disclose that the process gas contains carbon and hydrogen and a diamond-like carbon film is formed.

Ray teaches that diamond like carbon (DLC) films may be formed on a substrate by photochemical vapor deposition wherein low pressure mercury lamps are used to irradiate a process gas containing carbon and hydrogen (Abstract, p. L1559).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the photochemical vapor deposition process of Yamazaki by using a process gas containing carbon and hydrogen as suggested by Ray in order to form a DLC film on the substrate.

Thus, claims 3, 12, and 17 would have been obvious within the meaning of 35 USC 103 over the combined teachings of Yamazaki, Motoyama, and Ray.

7. Claims 4, 5, 13, 14, 18, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki ('610) in view of Motoyama et al (JP 2002-075876) as applied above and further in view of Horioka et al ('601).

Yamazaki and Motoyama do not disclose that the process gas contains a component reactive with the substrate material and a film (oxide, nitride, or carbonized) resulting from that reaction is formed on the substrate.

Horioka teaches a method of forming an oxide or nitride film on a silicon substrate, the method comprising: introducing a process gas containing oxygen or a nitrogen-containing gas to the chamber, and irradiating said process gas using a mercury lamp such that the oxygen or nitrogen reacts with the silicon substrate to form silicon oxide or silicon nitride (Col. 3, lines 17-55, Fig. 1).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to form the SiN film of Yamazaki by reacting the nitrogen-containing gas with the substrate as suggested by Horioka as a suitable alternative to using a silicon-containing process gas, especially since both Yamazaki and Horioka disclose silicon substrates, ammonia or hydrazine as the nitrogen-containing gas, and irradiating the process gas with mercury lamps.

Thus, claims 4, 5, 13, 14, 18, and 19 would have been obvious within the meaning of 35 USC 103 over the combined teachings of Yamazaki, Motoyama, and Horioka.

8. Claims 6 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki ('610) in view of Motoyama et al (JP 2002-075876) as applied above and further in view of Aoyama (JP 04-146620).

Yamazaki and Motoyama do not disclose that the process gas contains a non-reactive component and the collision of said component results in the flattening of the substrate surface.

Aoyama teaches flattening the surface of a semiconductor substrate by exposing said substrate to a process gas containing a non-reactive component and irradiating said process gas using a mercury lamp (Abstract, Fig. 1).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the process of Yamazaki by incorporating the process gas of Aoyama in order to flatten the semiconductor substrate surface such that a smoother film may be deposited, especially since Yamazaki teaches depositing the silicon nitride films on semiconductor substrates (Col. 1, lines 15-20).

Thus, claims 6 and 15 would have been obvious within the meaning of 35 USC 103 over the combined teachings of Yamazaki, Motoyama, and Aoyama.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elizabeth Burkhart whose telephone number is (571)272-6647. The examiner can normally be reached on M-Th 7-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

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you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Elizabeth Burkhart/
Examiner, Art Unit 1792

/Timothy H Meeks/
Supervisory Patent Examiner, Art Unit 1792